

REMARKS

In the last Office Action, the Examiner objected to claims 66 and 106 as containing informalities. Claims 1-3, 6-9, 11-14, 20-27 and 115-119 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,294,790 to Ohta et al. ("Ohta"). Claims 28-30, 31, 32, 33, 36, 37, 39-42, 44-49, 51, 52, 60-66, 68-74, 76-82, 84-96 and 112-114 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 5,969,821 to Muramatsu et al. ("Muramatsu"). Claims 10 and 15-17 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ohta in view of U.S. Patent No. 4,725,727 to Harder et al. ("Harder"). Claim 18 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ohta in view of U.S. Patent No. 6,088,320 to Bayer et al. ("Bayer") and Harder. Claim 19 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ohta in view of U.S. Patent No. 5,827,100 to Kim in view of Harder. Claim 34 was rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Ohta. Claims 50 and 53-57 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of U.S. Patent No. 5,796,706 to Shintani ("Shintani").

Claims 58-59 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Shintani and further in view of U.S. Patent No. 6,731,462 to Furuichi et al. ("Furuichi"). Claims 97 and 103 were rejected under 35

U.S.C. §103(a) as being unpatentable over Muramatsu in view of U.S. Patent No. 4,732,599 to Bennion. Claims 99 and 106 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of U.S. Patent No. 5,278,929 to Tanisawa et al. ("Tanisawa"). Claims 100-101 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of U.S. Patent No. 6,159,385 to Yao et al. ("Yao"). Claims 102-105 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of U.S. Patent No. 4,684,206 to Bednorz et al. ("Bednorz"). Claim 108 was rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Harder. Claim 111 was rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Tanisawa and Harder.

Claims 4, 5, 35, 38, 43, 67, 75 and 83 were objected to as being dependent upon a rejected base claim, but indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 98, 107, 109 and 110 were allowed by the Examiner. Additional art was cited of interest.

In accordance with the present response, independent claims 1, 11-20, 26-28, 31-33 and 96-113 have been amended to further patentably distinguish from the prior art of record. Claims 66 and 106 have been amended to overcome the objection

raised by the Examiner. Claims 1, 2, 8, 10-20, 26-28, 31-95 and 96-114 have also been amended in formal respects to the improve the wording and bring them into better conformance with U.S. practice.

In view of the foregoing, applicants respectfully submit that the objections to claims 66 and 106 have been overcome and should be withdrawn.

Applicants respectfully request reconsideration of their application in light of the following discussion.

Brief Summary of the Invention

The present invention is directed to a near-field optical head and to a method of manufacturing the near-field optical head.

As described in the specification (pgs. 1-7), conventional near-field optical heads have been unable to produce sufficient near-field light for recording information to and reading-out information from a recording medium with high speed, accuracy and efficiency. Additionally, conventional near-field optical heads have a rather large and complicated structure, thereby rendering them difficult to operate.

The present invention overcomes the drawbacks of the conventional art. Fig. 5 shows a near-field optical head 500

according to the present invention embodied in the claims. The near-field optical head 500 has a planar substrate 501 having a first surface, a second surface disposed opposite to the first surface, and an inverted conical or pyramidal hole 507 extending through the first and second surfaces and having at least one fine aperture 506 formed at an apex thereof and disposed on the first surface. An optical waveguide 504 is disposed on the second surface of the planar substrate 501 for propagating light along an optical path. A mirror 508 is disposed in the optical waveguide 504 for bending in the direction of the fine aperture 506 the optical path of the light propagated through the optical waveguide 504.

In another aspect, the present invention is directed to a method of manufacturing a near-field optical head. With reference to Figs. 6A-6B, a planar substrate 501 is provided having a first surface and a second surface opposite the first surface. An inverted conical or pyramidal hole 507 having a fine aperture at an apex thereof is formed through the first surface of the planar substrate 501 (S101). An optical waveguide 504 is formed on the second surface of the planar substrate for propagating light along an optical path (S102-104). A mirror 508 is formed in the optical waveguide 504 for bending in the direction of the fine aperture the optical path of the light propagated through the optical waveguide 504 (S105-S016).

By the foregoing construction of the near-field optical head and corresponding manufacturing method according to the present invention, the optical waveguide can be arranged close to the fine aperture. Additionally, the mirror and its location in the optical waveguide makes it possible to accurately focus the light propagated through the optical waveguide toward the fine aperture. Accordingly, the density of light illuminated to the fine aperture and the intensity of near-field light produced from the fine aperture are increased as compared to the conventional art. Furthermore, the near-field optical head according to the present invention has high mechanical strength, a compact structure, and can be easily mass-produced.

TRAVERSAL OF PRIOR ART REJECTIONS

Rejections Under 35 U.S.C. §102

Claims 1-3, 6-9, 11-14, 20-27 and 115-119

Claims 1-3, 6-9, 11-14, 20-27 and 115-119 were rejected under 35 U.S.C. §102(b) as being anticipated by Ohta. Applicants respectfully traverse this rejection and submit that amended claims 1-3, 6-9, 11-14, 20-27 and 115-119 recite subject matter which is not identically disclosed or described in Ohta.

Independent claim 1

Amended independent claim 1 is directed to a near-field optical head and requires a planar substrate having a first surface, a second surface disposed opposite to the first surface, and an inverted conical or pyramidal hole extending through the first and second surfaces and having at least one fine aperture formed at an apex thereof and disposed on the first surface. Claim 1 further requires an optical waveguide disposed on the second surface of the planar substrate for propagating light along an optical path, and a mirror disposed in the optical waveguide for bending in the direction of the fine aperture the optical path of the light propagated through the optical waveguide. No corresponding structural combination is disclosed or suggested by the prior art of record.

Ohta discloses a near-field optical head having an inverted conical hole 102 formed in a substrate 101 and an optical fiber 103 having a probe 108 with a sharpened tip having a fine aperture 110 (Fig. 2). The optical fiber 103 extends into the conical hole 102 so that the probe 108 and corresponding fine aperture 110 protrude from a surface of the substrate 101.

Ohta does not disclose or describe an inverted conical or pyramidal hole extending through the first and

second surfaces and having at least one fine aperture formed at an apex thereof and disposed in the first surface, as recited in independent claim 1. The fine aperture 110 in Ohta is formed at the tip of the probe 108 which protrudes from the surface of the substrate 101. Thus the fine aperture 110 in Ohta does not form part of a pyramidal or conical hole which extends through opposite surfaces of the substrate, as required by independent claim 1.

Ohta also does not disclose or describe a mirror disposed in the optical waveguide for bending in the direction of the fine aperture the optical path of the light propagated through the optical waveguide, as recited in amended claim 1. While a core 104 of the optical fiber 103 in Ohta is surrounded by a cladding 105 which is light reflective, the cladding 105 does not constitute a mirror for bending the propagated light toward the fine aperture. In Fig. 5 Ohta discloses three fiber bundles 120a-120c, rather than mirrors, for bending light introduced from light sources 123a-123c, respectively.

Independent Claims 11-14

Each of amended independent claims 11-14 is directed to a method of manufacturing a near-field optical head. Each of claim 11-14 requires the steps of forming through the first surface of the planar substrate an inverted conical or

pyramidal hole having a fine aperture at an apex thereof and forming a mirror in the optical waveguide for bending in the direction of the fine aperture the optical path of the light propagated through the optical waveguide. No corresponding steps are disclosed or described by Ohta as set forth above for amended independent claim 1.

Amended independent claim 20 is directed to a near-field optical head and requires a planar substrate having a first surface, a second surface disposed opposite the first surface, and an inverted conical or pyramidal hole extending through the first and second surfaces and having a fine aperture formed at an apex thereof and disposed on the first surface. Claim 20 further requires an optical waveguide having a first portion disposed on the second surface of the planar substrate and a second portion disposed on an inner surface of the inverted conical or pyramidal hole, the optical waveguide having a sharpened microscopic tip protruding from the fine aperture of the inverted conical or pyramidal hole. No corresponding structural combination is disclosed or described by Ohta.

Ohta does not disclose or describe an inverted conical or pyramidal hole extending through the first and second surfaces and having a fine aperture formed at an apex thereof and disposed on the first surface, as recited in claim 20, as set forth above for amended independent claim 1.

Moreover, Ohta does not disclose or describe an optical waveguide having a sharpened microscopic tip protruding from the fine aperture of the inverted conical or pyramidal hole, as recited in claim 20. In Ohta, the opening of the conical or pyramidal hole 102 through which the probe 108 extends is not a fine aperture (see Figs. 1-2). Furthermore, Ohta clearly does not disclose a sharpened microscopic tip (or any other structure) protruding from the fine aperture 110 of the probe 108.

In the absence of the foregoing disclosure recited in independent claims 1, 11-14 and 20, anticipation cannot be found. See, e.g., W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) ("Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration"); Continental Can Co. USA v. Monsanto Co., 20 USPQ2d 1746, 1748 (Fed. Cir. 1991) ("When more than one reference is required to establish unpatentability of the claimed invention anticipation under § 102 can not be found."); Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481, 485 (Fed. Cir. 1984) (emphasis added) ("Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim").

Stated otherwise, there must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention. This standard is clearly not satisfied by Ohta for the reasons stated above. Furthermore, Ohta does not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify Ohta's near-field optical head to arrive at the claimed invention.

Claims 2, 3, 6-9 and 21-27, 115-119 depend on and contain all of the limitations of amended independent claims 1 and 20, respectively, and, therefore, distinguish from the reference at least in the same manner as claims 1 and 20.

In view of the foregoing, applicants respectfully request that the rejection of claims 1-3, 6-9, 11-14, 20-27 and 115-119 under 35 U.S.C. §102(b) as being anticipated by Ohta be withdrawn.

Claims 28-30, 31, 32, 33, 36, 37, 39-42, 44-49, 51, 52, 60-66, 68-74, 76-82, 84-96, 112, 113 and 114

Claims 28-30, 31, 32, 33, 36, 37, 39-42, 44-49, 51, 52, 60-66, 68-74, 76-82, 84-96, 112, 113 and 114 were rejected under 35 U.S.C. §102(e) as being anticipated by Muramatsu. Applicants respectfully traverse this rejection and submit that amended claims 28-30, 31, 32, 33, 36, 37, 39-42, 44-49, 51, 52, 60-66, 68-74, 76-82, 84-96, 112, 113 and 114 recite

subject matter which is not identically disclosed or described in Muramatsu.

Independent Claims 28 and 31

Each of amended independent claims 28 and 31 is directed to a near-field optical head and requires an optical waveguide comprised of a first clad (claim 28) or a clad (claim 31) having at least one inverted conical or pyramidal hole extending therethrough in a thickness direction thereof. No corresponding structure is disclosed or described by Muramatsu.

Muramatsu discloses an optical waveguide probe (Figs. 2e, 2f, 2g) comprised of a clad 2a having an inverted pyramidal hole 6 extending therethrough. However, the inverted pyramidal hole 6 in Muramatsu extends in a longitudinal direction of the clad 2a, not in a thickness direction of the clad, as recited in amended claims 28 and 31.

Independent Claim 32

Amended independent claim 32 is directed to a method for manufacturing a near-field optical head and requires the step of forming in the first clad at least one inverted conical or pyramidal hole having a fine aperture at an apex thereof so that the inverted conical or pyramidal hole extends in a thickness direction of the first clad. No corresponding

step is disclosed or described by Muramatsu as set forth above for independent claims 28 and 31.

Independent Claim 33

Amended independent claim 33 is directed to the combination of a recording medium and a near field optical head for recording information to and reading-out information from the recording medium by utilizing near field light. Claim 33 requires an optical propagation member formed in a substrate and having at least one tapered hole forming a sharpened tip converging toward the recording medium, the tapered hole having a fine aperture formed at an apex thereof. Claim 33 further requires a light introducing part formed in the substrate for propagating light along an optical path extending in a direction generally parallel to a surface of the recording medium, and a light reflection layer disposed inside of the substrate for bending in the direction of the fine aperture the optical path of the light propagated through the light introducing part.

The structural combination of the near-field optical head recited in amended claim 33 is not disclosed or described by Muramatsu. For example, in Muramatsu a waveguide (light introducing part) 8 and a grating (light reflection layer) 30 are formed on a surface of a substrate 2. In contrast, amended claim 33 requires a light introducing part formed in

the substrate for propagating light along an optical path extending in a direction generally parallel to a surface of the recording medium, and a light reflection layer disposed inside of the substrate for bending in the direction of the fine aperture the optical path of the light propagated through the light introducing part.

Independent Claim 96

Amended independent claim 96 is directed to a method of manufacturing a near-field optical head and requires the step of forming in a first substrate a light propagation member having a tapered hole forming a sharpened tip configured to converge toward a recording medium, the tip having a fine aperture formed at an apex thereof. Claim 96 further requires the steps of forming in a second substrate a light introducing part for propagating light along an optical path disposed in a direction generally parallel to a surface of the recording medium, forming a light reflection layer on a surface of the second substrate for reflecting light propagated through the light introducing part toward the fine aperture of the light propagation member, and chemically etching a surface of a third substrate to form a focusing member disposed between the light reflection layer and the tapered hole of the light propagation member and having a convex portion.

Muramatsu does not disclose or describe the combination of steps recited in amended claim 96. For example, in Fig. 2f of Muramatsu, the tapered hole in the sharpened tip 2a, the grating 30 and the waveguide portion (light introducing part) 8 are formed in the same substrate 2. In contrast, in amended claim 96, the tapered hole, the light introducing part and the light reflection layer are formed in two different substrates. Furthermore, Muramatsu does not disclose the step of chemically etching a surface of a third substrate to form a focusing member disposed between the light reflection layer and the tapered hole of the light propagation member, as recited in amended claim 96.

Independent Claim 112

Amended independent claim 112 is directed a method of manufacturing a near field optical head and requires the steps of providing a first substrate having a fine aperture formed in a first surface thereof, disposing a second substrate on a second surface of the first substrate opposite the first surface thereof, and forming in the second substrate a light propagation member having a tapered hole forming a sharpened tip configured to converge toward a recording medium during operation of the near field optical head, the sharpened tip having a fine aperture formed at an apex thereof. Claim 112 further requires the steps of forming in the second

substrate a light introducing part for propagating light along an optical path disposed in a direction generally parallel to a surface of the recording medium, and forming in the second substrate a light reflection layer for reflecting light propagated through the light introducing part toward the fine aperture of the light propagation member. Muramatsu does not disclose or describe the steps of forming the components of the near-field optical head in different substrates as set forth above for amended independent claim 96.

Independent Claim 113

Amended independent claim 113 is directed a method of manufacturing a near field optical head and requires the steps of subjecting a surface of a substrate to a chemical reaction to form a slant surface having a constant angle defined by a planar orientation, forming a light reflection layer by disposing a metal film on the slant surface, forming a light introducing part by disposing a dielectric material on a top surface of the light reflection layer, planarizing the dielectric material, subjecting a portion of the planarized material to a chemical reaction to form a tapered hole which converges toward a surface of a recording medium during use of the near field optical head, disposing a metal film on a surface of the tapered hole, and working the metal film at an apex of the tapered hole to form a fine aperture.

Muramatsu does not disclose or describe the combination of steps recited in amended claim 113. For example, in Figs. 8a-8d of Muramatsu, the reflection layer 10 is not formed by disposing a metal film on a slant surface of the substrate 2. As shown in Fig. 8a of Muramatsu, the light reflection layer is disposed on an insulating layer 72 which is disposed on an electrode 71 which is disposed on a flat, not slant, surface of the substrate 2.

Since Muramatsu does not disclose or describe the forgoing features recited in each of amended independent claims 28, 31-33, 96, 112 and 113, there can be no anticipation by Muramatsu of independent claims 28, 31-33, 96, 112 and 113 under 35 U.S.C. §102(e). That is, since each and every limitation of amended independent claims 28, 31-33, 96, 112 and 113 is not found in Muramatsu, the reference does not anticipate the claimed invention. See In re Lange, 209 USPQ 288, 293 (CCPA 1981). Furthermore, Muramatsu does not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify Muramatsu's optical waveguide probe to arrive at the claimed invention.

Claims 29-30, and 36, 37, 39-42, 44-49, 51, 52, 60-66, 68-74, 76-82, 84-95, 114 depend on and contain all of the limitations of amended independent claims 28 and 33, respectively, and, therefore, distinguish from the reference at least in the same manner as claims 28 and 33.

In view of the foregoing, applicants respectfully request that the rejection of claims 28-30, 31, 32, 33, 36, 37, 39-42, 44-49, 51, 52, 60-66, 68-74, 76-82, 84-96, 112, 113 and 114 under 35 U.S.C. §102(e) as being anticipated by Muramatsu be withdrawn.

Rejections Under 35 U.S.C. §103(a)

Claims 10 and 15-17

Claims 10 and 15-17 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ohta in view of Harder. Applicants respectfully traverse this rejection and submit that the combined teachings of Ohta and Harder do not disclose or suggest the subject matter recited in amended claims 10 and 15-17.

Ohta does not disclose or suggest the subject matter recited in amended independent claim 1 as set forth above for the rejection under 35 U.S.C. §102(b). Claim 10 depends on and contains all of the limitations of amended independent claim 1 and, therefore, distinguishes from the reference at least in the same manner as claim 1.

The Examiner cited the secondary reference to Harder for its disclosure of a near-field optical head having a plurality of fine apertures. However, Harder does not disclose or suggest the structural combination of the near-

field optical head recited in amended independent claim 1, from which claim 10 depends, including the specific structural and positional relationship between the inverted conical or pyramidal hole, optical waveguide and mirror. Since Harder does not disclose or suggest these features, it does not cure the deficiencies of Ohta. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

Each of amended independent claims 15-17 is directed to a method for manufacturing a near-field optical head and requires the steps of providing a planar substrate, and forming through a surface of the planar substrate an inverted conical or pyramidal hole having a fine aperture at an apex thereof for scattering near field light. Claim 15 further requires the step of forming a light reflection film on an inner surface of the inverted cone or pyramidal to reduce a diameter of the fine aperture in accordance with a thickness of the light reflection film. Claim 16 further requires the step of forming a light reflection film having a variable thickness on an inner surface of the inverted conical or pyramidal hole to change the shape of the fine aperture to a shape defined by a thickness of the light reflection film. Claim 17 further requires the step of forming a light reflection film on a surface of the planar substrate having

the fine aperture to reduce a diameter of the fine aperture in accordance with a thickness of the light reflection film. No corresponding combination of steps are disclosed or suggested by the combined teachings of Ohta and Harder.

The primary reference to Ohta discloses a near-field optical head as set forth above for the rejection under 35 U.S.C. §102(b). Ohta does not disclose the step of forming through a surface of the planar substrate an inverted conical or pyramidal hole having a fine aperture at an apex thereof, as recited in claims 15-17. In Ohta, the open end of the conical hole 102 formed in the substrate 101 is not a fine aperture. The fine aperture in Ohta is denoted by reference numeral 110 and is formed at a sharpened tip of the probe 108 which protrudes from a surface of the substrate 101.

Moreover, as recognized by the Examiner, Ohta does not disclose or suggest the steps (1) forming a light reflection film on an inner surface of the inverted cone or pyramidal to reduce a diameter of the fine aperture in accordance with a thickness of the light reflection film (claim 15), (2) forming a light reflection film having a variable thickness on an inner surface of the inverted conical or pyramidal hole to change the shape of the fine aperture to a shape defined by a thickness of the light reflection film (claim 16), and (3) forming a light reflection film on a

surface of the planar substrate having the fine aperture to reduce a diameter of the fine aperture in accordance with a thickness of the light reflection film (claim 17), as recited in amended claims 15-17.

The Examiner cited the secondary reference to Harder for its disclosure of a near-field optical probe having a transparent layer 15 enclosed between opaque layers 14, 16 to form an annular aperture 17 and a central aperture 18 (Fig. 2). However, Harder does not disclose or suggest the step of forming through a surface of the planar substrate an inverted conical or pyramidal hole having a fine aperture at an apex thereof, as recited in each of claims 15-17. Stated otherwise, in Harder the aperture 18 is formed by coating a transparent body 13 with the opaque layer 14. In contrast, in each of claims 15-17 the inverted conical or pyramidal hole having a fine aperture at an apex thereof is formed through a surface of the planar substrate.

Moreover, Harder does not disclose or suggest the foregoing steps (1)-(3) recited in claims 15-17. More specifically, Harder does not disclose or suggest the step of forming a light reflection film on an inner surface of an inverted cone or pyramidal hole (e.g., between the transparent body 13 and the opaque layer 14), the reflection film having a variable thickness, or the step of forming a light reflection

film on a surface of a planar substrate having the fine aperture, for the purpose of reducing the diameter or change the shape of the fine aperture, as recited in claims 15-17.

Since Harder does not disclose or suggest the foregoing combination of steps recited in amended independent claims 15-17, it does not cure the deficiencies of Ohta. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claims 10 and 15-17 under 35 U.S.C. §103(a) as being unpatentably over Ohta in view of Harder be withdrawn.

Claim 18

Claim 18 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ohta in view of Harder and Bayer. Applicants respectfully traverse this rejection and submit that the combined teachings of Ohta, Harder and Bayer do not disclose or suggest the subject matter recited in amended independent claim 18.

Amended independent claim 18 is directed to a method for manufacturing a near-field optical head and requires the steps of providing a planar substrate, forming through a surface of the planar substrate an inverted conical or

pyramidal hole having a fine aperture at an apex thereof for scattering near field light, and forming an oxide film on a surface of the planar substrate forming a taper of the inverted conical or pyramidal hole to reduce a diameter of the fine aperture in accordance with a thickness of the oxide film.

Ohta in view of Harder does not disclose or suggest the step of forming through a surface of the planar substrate an inverted conical or pyramidal hole having a fine aperture at an apex thereof, as recited in claim 18, as set forth above for the rejection of claims 10 and 15-17 under 35 U.S.C. §103(a).

Furthermore, as recognized by the Examiner, Ohta in view of Harder does not disclose or suggest the step of forming an oxide film on a surface of the planar substrate forming a taper of the inverted conical or pyramidal hole to reduce a diameter of the fine aperture in accordance with a thickness of the oxide film, as recited in claim 18. In this regard, a metal film 109 in Ohta, which is not an oxide film as required by claim 18, is formed on a taper of the probe 108, not on a taper of an inverted conical or pyramidal hole which is formed through a surface of the planar substrate, as required by claim 18.

The Examiner cited the secondary reference to Bayer for its disclosure of a tapered surface of a probe coated with an oxide film. The Examiner contends that it would have been obvious to one of ordinary skill in the art at the time the invention was made to manufacture the probe 108 in Ohta with an oxide film, instead of the metal film 109, as taught by Bayer. Applicants respectfully disagree with the Examiner's contention.

First, in the context of obviousness rejections based upon the purported obviousness of effecting a required modification, the Federal Circuit has held that "[t]he mere fact that the prior art may be modified in [a given] manner ... does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992). In this case, there is nothing in Bayer that would have suggested replacing the metal film 109 in Ohta with the oxide film of Bayer.

Moreover, even if it were obvious to replace the metal film 109 in Ohta with the oxide film of Bayer as proposed by the Examiner, the proposed modification of Ohta would not result in the claimed invention. More specifically, the substitution of the metal film 109 in Ohta with the oxide film of Bayer would not result in an oxide film being formed on a taper of an inverted conical or pyramidal hole which is

formed through a surface of the planar substrate, as required by claim 18, as set forth above.

In view of the foregoing, applicants respectfully request that the rejection of claim 18 under 35 U.S.C. §103(a) as being unpatentably over Ohta in view of Harder and Bayer be withdrawn.

Claim 19

Claim 19 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ohta in view of Harder and Kim. Applicants respectfully traverse this rejection and submit that the combined teachings of Ohta, Harder and Kim do not disclose or suggest the subject matter recited in amended independent claim 19.

Amended independent claim 19 is directed to a method for manufacturing a near field optical head and requires the steps of providing a planar substrate, forming through a surface of the planar substrate an inverted conical or pyramidal hole having a fine aperture at an apex thereof for scattering near field light, and implanting ions in a surface of the planar substrate forming a taper of the inverted conical or pyramidal hole to reduce a diameter of the fine aperture in accordance with an increase in a thickness of the surface of the planar substrate due to the implanted ions.

Ohta in view of Harder does not disclose or suggest the step of forming through a surface of the planar substrate an inverted conical or pyramidal hole having a fine aperture at an apex thereof, as recited in claim 19, as set forth above for the rejection of claims 10 and 15-17 under 35 U.S.C. §103(a).

Furthermore, as recognized by the Examiner, Ohta in view of Harder does not disclose or suggest the step of implanting ions in a surface of the planar substrate forming a taper of the inverted conical or pyramidal hole to reduce a diameter of the fine aperture in accordance with an increase in a thickness of the surface of the planar substrate due to the implanted ions, as recited in claim 19.

The Examiner cited the secondary reference to Kim for its disclosure of forming a cone-shaped having a tip on a semiconductor layer by an ion etching method. However, Kim does not disclose or suggest the step of forming through a surface of the planar substrate an inverted conical or pyramidal hole having a fine aperture at an apex thereof, as recited in claim 19. Furthermore, Kim does not disclose or suggest the step of implanting ions in a surface of a planar substrate forming a taper of the inverted conical or pyramidal hole to reduce a diameter of the fine aperture in accordance with an increase in a thickness of the surface of the planar

substrate due to the implanted ions, as recited in amended claim 19. Since Kim does not disclose or suggest these steps, it does not cure the deficiencies of Ohta as modified by Harder. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 19 under 35 U.S.C. §103(a) as being unpatentably over Ohta in view of Harder and Kim be withdrawn.

Claim 34

Claim 34 was rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Ohta. Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu and Ohta do not disclose or suggest the subject matter recited in amended claim 34.

Muramatsu does not disclose or suggest the subject matter recited in amended independent claim 33 as set forth above for the rejection under 35 U.S.C. §102(e). Claim 34 depends on and contains all of the limitations of amended independent claim 33 and, therefore, distinguishes from the reference at least in the same manner as claim 33.

The secondary reference to Ohta has been cited by the Examiner for its disclosure of a tapered hole having a

plurality of tapered surfaces with different tapered angles. However, Ohta does not disclose or suggest the structural combination of the near-field optical head recited in amended claim 33, from which claim 34 depends, including the structural and positional relation between the tapered hole, light introducing part and light reflection layer. Since Ohta does not disclose or suggest these features, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 34 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Ohta be withdrawn.

Claims 50 and 53-57

Claims 50 and 53-57 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Shintani. Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu and Shintani do not disclose or suggest the subject matter recited in amended claims 50 and 53-57.

Muramatsu does not disclose or suggest the subject matter recited in amended independent claim 33 as set forth above for the rejection under 35 U.S.C. §102(e). Claims 50

and 53-57 depend on and contain all of the limitations of amended independent claim 33 and, therefore, distinguish from the reference at least in the same manner as claim 33.

The secondary reference to Shintani has been cited by the Examiner for its disclosure of a near-field optical head floating on a liquid layer. However, Shintani does not disclose or suggest the structural combination of the near-field optical head recited in amended claim 33, from which claim 34 depends, including the structural and positional relation between the tapered hole, light introducing part and light reflection layer. Since Shintani does not disclose or suggest these features, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claims 50 and 53-57 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Shintani be withdrawn.

Claims 58 and 59

Claims 58 and 59 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Shintani and Furuichi. Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu,

Shintani and Furuichi do not disclose or suggest the subject matter recited in amended claims 58 and 59.

Muramatsu in view of Shintani does not disclose or suggest the subject matter recited in dependent claim 53 as set forth above for the rejection of claims 50 and 53-57 under 35 U.S.C. §103(a). Claims 58-59 depend on and contain all of the limitations of dependent claim 53 and, therefore, distinguish from the references at least in the same manner as claim 53.

The reference to Furuichi has been cited by the Examiner for its disclosure of a slider structure having at least one portion made of a dielectric material or a metal. However, Furuichi does not disclose or suggest the structural combination of the near-field optical head recited in amended claim 33, from which claims 53 and 58-59 depend, including the structural and positional relation between the tapered hole, light introducing part and light reflection layer. Since Furuichi does not disclose or suggest these features, it does not cure the deficiencies of Muramatsu as modified by Shintani. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claims 58-59 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Shintani and Furuichi be withdrawn.

Claim 97

Claim 97 was rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Bennion. Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu and Bennion do not disclose or suggest the subject matter recited in amended independent claim 97.

Amended independent claim 97 is directed to a method of manufacturing a near field optical head and requires the step of forming in a first substrate a light propagation member having a tapered hole forming a sharpened tip configured to converge toward a recording medium, the tip having a fine aperture formed at an apex thereof. Claim 97 further requires the steps of forming in a second substrate a light introducing part for propagating light along an optical path disposed in a direction generally parallel to a surface of the recording medium, forming a light reflection layer on a surface of the second substrate for reflecting light propagated through the light introducing part toward the fine aperture of the light propagation member, and subjecting a

surface of a third substrate to selective ion exchange to form a focusing member disposed between the light reflection layer and the tapered hole of the light propagation member and having a convex portion.

As recognized by the Examiner, the primary reference to Muramatsu does not disclose or suggest the step of subjecting a surface of a third substrate to selective ion exchange to form a focusing member disposed between the light reflection layer and the tapered hole of the light propagation member, as recited in amended claim 97. Furthermore, Muramatsu does not disclose or suggest the steps of forming a light propagation member, a light introducing part, a light reflection layer, and a focusing member using different substrates, as recited in amended claim 97. For example, in Muramatsu the light propagation member 2 and the grating (light reflection layer) 300 are formed in the same substrate (see Fig. 2(f)).

The secondary reference to Bennion has been cited by the Examiner for its disclosure of a method of fabricating an optical displacement sensing device using an ion exchange process. However, Bennion does not disclose or suggest the combination of steps recited in amended claim 97, including the steps of forming a light propagation member, a light introducing part, a light reflection layer, and a focusing

member using different substrates. Since Bennion does not disclose or suggest these steps, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 97 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Bennion be withdrawn.

Claims 99 and 106

Claims 99 and 106 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Tanisawa. Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu and Tanisawa do not disclose or suggest the subject matter recited in amended claims 99 and 106.

Amended independent claim 99 is directed to a method of manufacturing a near-field optical head and requires the step of forming in a first substrate a light propagation member having a tapered hole forming a sharpened tip configured to converge toward a recording medium during use of the near-field optical head, the tip having a fine aperture formed at an apex thereof. Claim 99 further requires the steps of forming in a second substrate a light introducing

part for propagating light along an optical path disposed in a direction generally parallel to a surface of the recording medium, forming a light reflection layer on a surface of the second substrate for reflecting light propagated through the light introducing part toward the fine aperture of the light propagation member, and bringing a surface of a third substrate into contact with a liquid having a curved surface and exposed to UV radiation to form a focusing member disposed between the light reflection layer and the tapered hole of the light propagation member and having a convex portion.

As recognized by the Examiner, the primary reference to Muramatsu does not disclose or suggest the step of bringing a surface of a third substrate into contact with a liquid having a curved surface and exposed to UV radiation to form a focusing member disposed between the light reflection layer and the tapered hole of the light propagation member, as recited in claim 99. Furthermore, Muramatsu does not disclose or suggest the steps of forming a light propagation member, a light introducing part, a light reflection layer, and a focusing member using different substrates, as recited in amended claim 99. For example, in Muramatsu the light propagation member 2 and the grating (light reflection layer) 300 are formed in the same substrate (see Fig. 2(f)).

With respect to claim 99, the Examiner cited the secondary reference to Tanisawa for its disclosure of a method of forming a connection of an optical waveguide with UV setting. However, Tanisawa does not disclose or suggest the combination of steps recited in amended claim 99, including the steps of forming a light propagation member, a light introducing part, a light reflection layer, and a focusing member using different substrates. Since Tanisawa does not disclose or suggest these steps, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

Amended independent claim 106 is also directed to a method for manufacturing a near-field optical head and requires the step of forming a tapered hole having a sharpened tip in a first surface of a dielectric material, the sharpened tip being configured to converge toward a recording medium during use of the near field optical head. Claim 106 further requires the steps of disposing a metal film on a periphery of the tapered hole including the sharpened tip, deforming the metal film in the vicinity of the sharpened tip to form a fine aperture, applying a liquid over a second surface of the dielectric material opposite the first surface thereof and subjecting the liquid to UV radiation to form a convex surface

portion, and bonding onto the convex surface portion of the dielectric material a light introducing part for propagating light in a direction generally parallel to a surface of the recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the fine aperture.

As recognized by the Examiner, Muramatsu does not disclose or suggest the steps of (1) applying a liquid over a second surface of the dielectric material opposite the first surface thereof and subjecting the liquid to UV radiation to form a convex surface portion and (2) bonding onto the convex surface portion of the dielectric material a light introducing part for propagating light in a direction generally parallel to a surface of the recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the fine aperture, as recited in amended claim 106.

Likewise, Tanisawa does not disclose or suggest the foregoing steps (1) and (2) recited in amended independent claim 106. For example, while disclosing the formation of a connection for an optical waveguide with UV setting, Tanisawa does not disclose or suggest the formation of a convex portion on the surface of a dielectric material utilizing UV radiation, as recited in amended claim 106. Since Tanisawa

does not disclose or suggest these steps, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claims 99 and 106 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Tanizawa be withdrawn.

Claims 100 and 101

Claims 100 and 101 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Yao. Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu and Yao do not disclose or suggest the subject matter recited in amended claims 100 and 101.

Amended independent claim 100 is directed to a method of manufacturing a near-field optical head and requires the step of forming in a first substrate a light propagation member having a tapered hole forming a sharpened tip configured to converge toward a recording medium during use of the near-field optical head, the sharpened tip having a fine aperture formed at an apex thereof. Amended claim 100 further requires the steps of forming in a second substrate a light

introducing part for propagating light along an optical path disposed in a direction generally parallel to a surface of the recording medium, forming a light reflection layer on a surface of the second substrate for reflecting light propagated through the light introducing part toward the fine aperture of the light propagation member, and bringing a surface of a third substrate into contact with a thermosetting liquid having a curved surface to form a focusing member disposed between the light reflection layer and the tapered hole of the light propagation member and having a convex portion.

As recognized by the Examiner, the primary reference to Muramatsu does not disclose or suggest the step of bringing a surface of a third substrate into contact with a thermosetting liquid having a curved surface to form a focusing member disposed between the light reflection layer and the tapered hole of the light propagation member, as recited in claim 100. Furthermore, Muramatsu does not disclose or suggest the steps of forming a light propagation member, a light introducing part, a light reflection layer, and a focusing member using different substrates, as recited in amended claim 100. For example, in Muramatsu the light propagation member 2 and the grating (light reflection layer) 300 are formed in the same substrate (see Fig. 2(f)).

With respect to claim 100, the Examiner cited the secondary reference to Yao for its disclosure of a cantilever device having a connection formed by thermosetting. However, Yao does not disclose or suggest the combination of steps recited in amended claim 100, including the steps of forming a light propagation member, a light introducing part, a light reflection layer, and a focusing member using different substrates. Since Yao does not disclose or suggest these steps, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

Amended independent claim 101 is directed to a method of manufacturing a near-field optical head and requires the step of forming a light propagation member by subjecting a surface of a first substrate to a chemical reaction to form a tapered hole forming a sharpened tip configured to converge toward a recording medium during use of the near-field optical head, the sharpened tip having a fine aperture formed at an apex thereof. Claim 101 further requires the steps of forming in a second substrate a light introducing part for propagating light along an optical path disposed in a direction generally parallel to a surface of the recording medium, and forming a light reflection layer on a surface of the second substrate

for reflecting light propagated through the light introducing part toward the fine aperture of the light propagation member.

As recognized by the Examiner, the primary reference to Muramatsu does not disclose or suggest the step of forming a light propagation member by subjecting a surface of a first substrate to a chemical reaction to form a tapered hole forming a sharpened tip having a fine aperture formed at an apex thereof, as recited in claim 101. Furthermore, Muramatsu does not disclose or suggest the steps of forming the tapered hole and the light introducing part and light reflection layer using different substrates, as recited in amended claim 101. For example, in Muramatsu the light propagation member 2 and the grating (light reflection layer) 300 are formed in the same substrate (see Fig. 2(f)).

With respect to claim 101, the Examiner cited the secondary reference to Yao for its disclosure of a cantilever device having conductive surfaces formed by a chemical reaction. However, Yao does not disclose or suggest the combination of steps recited in amended claim 100, including the steps of forming a tapered hole, light introducing part, and light reflection layer of the near-field optical head using different substrates. Since Yao does not disclose or suggest these steps, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art

would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claims 100-101 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Yao be withdrawn.

Claims 102-105

Claims 102-105 were rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Bednorz. Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu and Bednorz do not disclose or suggest the subject matter recited in amended claims 102-105.

Amended independent claim 102 is directed to a method of manufacturing a near-field optical head and requires the step of forming a light propagation member by forming in a first substrate a tapered hole having a sharpened tip configured to converge toward a recording medium during use of the near-field optical head, covering at least a surface of the tapered hole at the tip thereof with a metal, and plastically deforming the metal in the vicinity of an apex of the tip using a material harder than the metal to form a fine aperture at the apex. Claim 102 further requires the steps of forming in a second substrate a light introducing part for

propagating light along an optical path disposed in a direction generally parallel to a surface of the recording medium, and forming a light reflection layer on a surface of the second substrate for reflecting light propagated through the light introducing part toward the fine aperture of the light propagating member.

As recognized by the Examiner, the primary reference to Muramatsu does not disclose or suggest the step of plastically deforming the metal in the vicinity of an apex of the tip using a material harder than the metal to form a fine aperture at the apex, as recited in claim 101. Furthermore, Muramatsu does not disclose or suggest the steps of forming the tapered hole and the light introducing part and light reflection layer using different substrates, as recited in amended claim 102. For example, in Muramatsu the light propagation member 2 and the grating (light reflection layer) 300 are formed in the same substrate (see Fig. 2(f)).

With respect to claim 102, the Examiner cited the secondary reference to Bednorz for its disclosure of a light probe having an aperture formed by plastically deforming a metal in the vicinity of an apex of a taper using a material harder than the metal. However, Bednorz does not disclose or suggest the combination of steps recited in amended claim 102, including the steps of forming a tapered hole, light

introducing part, and light reflection layer of the near-field optical head using different substrates. Since Bednorz does not disclose or suggest these steps, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

Amended independent claim 103 is also directed to a method of manufacturing a near-field optical head and requires the step of forming a tapered hole having a sharpened tip in a first surface of a dielectric material, the sharpened tip being configured to converge toward a recording medium during use of the near field optical head. Claim 103 further requires the steps of disposing a metal film on a periphery of the tapered hole including the sharpened tip, deforming the metal film in the vicinity of the sharpened tip to form a fine aperture, working a second surface of the dielectric material opposite the first surface thereof to form a convex surface portion, and bonding onto the convex surface portion of the dielectric material a light introducing part for propagating light in a direction generally parallel to a surface of the recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the fine aperture.

Muramatsu does not disclose or suggest the steps of (1) forming a tapered hole having a sharpened tip in a first surface of a dielectric material and (2) working a second surface of the dielectric material opposite the first surface thereof to form a convex surface portion, as recited in claim 103. For example, in Muramatsu the optical waveguide probe shown in Fig. 2(e) has a sharpened tip 2a but not a convex surface portion. In Fig. 8(d) of Muramatsu, the waveguide does not have a sharpened tip and a convex surface formed on opposite surfaces of a dielectric material.

The secondary reference to Bednorz also fails to disclose steps (1) and (2) recited in amended claim 103. Accordingly, Bednorz does not cure the deficiencies of Muramatsu and, therefore, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

Amended independent claim 104 is also directed to a method of manufacturing a near-field optical head and likewise distinguishes from Muramatsu and Bednorz. More specifically, amended claim 104 requires the steps of forming a tapered hole having a sharpened tip in a first surface of a dielectric material and subjecting a second surface of the dielectric material opposite the first surface thereof to selective ion exchange to form a convex surface portion. The combined

teachings of Muramatsu and Bednorz do not disclose or suggest the formation of a sharpened tip and a convex surface on opposite surfaces of a dielectric material, as recited in amended claim 104.

Amended independent claim 105 is also directed to a method of manufacturing a near-field optical head and likewise distinguishes from Muramatsu and Bednorz. More specifically, amended claim 104 requires the steps of forming a tapered hole having a sharpened tip in a first surface of a dielectric material, and subjecting a second surface of the dielectric material opposite the first surface thereof to selective ion exchange to provide the second surface with a refractivity gradient which varies in a stepwise manner. The combined teachings of Muramatsu and Bendorz do not disclose or suggest the foregoing steps involving the use of a single dielectric material in which the tapered hole is formed in one surface of the dielectric material and in which an opposite surface of the dielectric material is provided with a refractivity gradient which varies in a stepwise manner, as required by claim 105.

In view of the foregoing, applicants respectfully request that the rejection of claims 102-105 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Bednorz be withdrawn.

Claim 108

Claim 108 was rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Harder.

Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu and Harder do not disclose or suggest the subject matter recited in amended claim 108.

Amended independent claim 108 is directed to a method for manufacturing a near-field optical head and requires the steps of forming in a first surface of a substrate a tapered hole having a first fine aperture at an apex thereof, disposing a metal film on a periphery of the tapered hole, deforming the metal film in the periphery of the tapered hole to form a second fine aperture in the first surface of the substrate, providing a dielectric material with a surface having a convex portion and bonding the dielectric material to a second surface of the substrate opposite the first surface thereof, and bonding onto the surface of the dielectric material a light introducing part for propagating light in a direction generally parallel to a surface of the recording medium and generally perpendicular to the surface of the dielectric material and a light reflection layer for reflecting light propagated through the light introducing part toward the first and second fine apertures.

As recognized by the Examiner, the primary reference to Muramatsu does not disclose or suggest the steps of disposing a metal film on a periphery of the tapered hole, and deforming the metal film in the periphery of the tapered hole to form a second fine aperture in the first surface of the substrate, as recited in amended claim 108. Furthermore, Muramatsu does not disclose or suggest the step of bonding the dielectric material to a surface of the substrate opposite to a surface of the substrate in which the tapered hole and the second fine aperture are formed, as required by amended claim 108.

The Examiner cited the secondary reference to Harder for its disclosure of a waveguide for a near-field optical probe having first and second fine apertures. However, Harder does not disclose or suggest the step of bonding the dielectric material to a surface of the substrate opposite to a surface of the substrate in which the tapered hole and the second fine aperture are formed, as required by amended claim 108. Since Harder does not disclose or suggest this step, it does not cure the deficiencies of Muramatsu. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 108 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Harder be withdrawn.

Claim 111

Claim 111 was rejected under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Tanisawa and Harder. Applicants respectfully traverse this rejection and submit that the combined teachings of Muramatsu, Tanisawa and Harder do not disclose or suggest the subject matter recited in amended claim 111.

Amended independent claim 111 is directed to a method for manufacturing a near-field optical head and requires the steps of forming in a first surface of a substrate a tapered hole having a first fine aperture at an apex thereof, disposing a metal film on a periphery of the tapered hole, deforming the metal film in the periphery of the tapered hole to form a second fine aperture in the first surface of the substrate, applying a liquid over a second surface of the substrate opposite the first surface thereof and subjecting the liquid to UV radiation to form a convex surface portion, and bonding onto the convex surface portion of the dielectric material a light introducing part for propagating light in a direction generally parallel to a

surface of the recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the first and second fine apertures. No corresponding combination of steps is disclosed or suggested by the combined teachings of Muramatsu, Tanisawa and Harder.

As recognized by the Examiner, the combined teachings of Muramatsu and Harder do not disclose or suggest the step of applying a liquid over a second surface of the dielectric material opposite the first surface thereof and subjecting the liquid to UV radiation to form a convex surface portion, as recited in amended claim 111. Furthermore, Muramatsu does not disclose or suggest the step of forming the tapered hole having a first fine aperture at an apex thereof in a surface of the substrate opposite to the surface thereof in which the liquid is applied and subjected to UV radiation to form the convex surface portion, as required by amended claim 111.

The Examiner cited Tanizawa for its disclosure of an optical module having an aperture in a convex form formed with UV setting. However, Tanizawa does not disclose or suggest the step of forming the tapered hole having a first fine aperture at an apex thereof in a surface of the substrate opposite to the surface thereof in which the liquid is applied and subjected to UV radiation to form the convex surface

portion, as required by amended claim 111. Since Tanizawa does not disclose or suggest this step, it does not cure the deficiencies of Muramatsu as modified by Harder. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 111 under 35 U.S.C. §103(a) as being unpatentable over Muramatsu in view of Harder and Tanizawa be withdrawn.

In view of the foregoing amendments and discussion,
the application is believed to be in allowable form.
Accordingly, favorable reconsideration and allowance of the
claims are most respectfully requested.

Respectfully submitted,

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MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: MS NON-FEE AMENDMENT, COMMISSIONER FOR PATENTS, P.O. Box 1450, Alexandria, VA 22313-1450, on the date indicated below.

Debra Buonincontri

Name

Debra Buonincontri

Signature

September 7, 2004

Date